IN THE CLAIMS:

Please amend the claims to read as follows. This is a complete listing of all claims and replaces any prior listing in this application.

1-71 (cancelled).

72. (currently amended) A **computerized** method for projecting information data from a multidimensional space onto a space having lesser dimensions, comprising:

~~providing~~ **receiving** a database of N-dimensional data in the form of records having a certain number of variables;

defining a metric function for calculating a distance between each record in the database;

calculating a matrix of distances between each record in the database using said metric function;

defining a N-1 dimensional space in which each record is defined by N-1 coordinates;

calculating the N-1 coordinates of each record in the N-1 dimensional space using an evolutionary algorithm;

defining a best projection of the records onto the N-1 dimensional space as a projection in which a distance matrix of the records in the N-1 dimensional space one of best fits or has minimum differences with the distance matrix of the records calculated in the N-dimensional space, **and**

outputting said best projection of the records to a user,

wherein said receiving, defining, calculating and outputting are performed by a data processor, and wherein in said evolutionary algorithm the number of marriages and of mutations of individuals are adaptive self-definable internal variables.

73. (previously presented) The method of claim 72, wherein the database of N-dimensional data already contains data as to distances between the records.

74. (previously presented) The method of claim 72, wherein said evolutionary algorithm is a genetic algorithm.

75. (previously presented) The method of claim 72, further comprising:

encoding each individual record or variable as a point having coordinates X and Y;

defining a set of different X and Y coordinates for each point forming a first population of projections solution onto the lesser dimensional space;

calculating a fitness score for each of the projections of the first population by using as a fitness function the matrix of distances of the single points in the original N-dimensional space;

subjecting the population of projections to combination according to certain combinatorial rules to produce a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation; and

calculating the fitness score of the projections of the first generation and forming a new generation basing on said first generation.

76. (currently amended) The method of claim 74, wherein the genetic algorithm is the ~~GenD~~ Genetic Doping Algorithm ~~algorithm~~.

77. (previously presented) The method of claim 72, wherein a hidden point is defined which corresponds to a hidden record or a to a hidden variable whose existence is only guessed at, said hidden point being added to the parent population by giving it position coordinates X_{hi} and Y_{hi} in the projection.

78. (previously presented) The method of claim 77, wherein the calculation of the evolutionary algorithm is carried out in parallel with and without the hidden point and wherein best fit projections obtained from said two parallel calculations are compared.

79. (previously presented) The method of claim 72, further comprising:

providing a database comprising at least two records, each record having a certain number of variables;

elaborating the database alternatively or in parallel:

in a first manner in which the records are considered as being points and the variables as the coordinates of the points; and

in a second manner in which the variables are considered as being points and the records as the coordinates of the points.

80. (previously presented) The method of claim 72, further comprising operating on the database in a pre-processing or post-processing phase.

81. (previously presented) The method of claim 80, wherein the database is processed in a preventive stage by means of a Self Organising Map algorithm, and wherein the clusters formed by this algorithm in the different units are projected to said lesser dimensional space.

82. (currently amended) A **computerized** method for the cognitive analysis of multidimensional information data, comprising:

~~providing~~ **receiving** a database with a certain number of records, each record comprising a certain number of variables and being relative to a N-dimensional space;

projecting the database onto a space having a lesser number of dimensions relative to the N-dimensional space, considering the records as points and the variables as coordinates, or the variables as points and the records as coordinates;

carrying out said projection using an algorithm for projecting information data belonging to a multidimensional space into a space having lesser dimensions by:

calculating a matrix of distances between each point defined by a record or a variable of the database using a metric function;

defining a N-1 dimensional space in which each point represented by a record or a variable is defined by N-1 coordinates[[.]] **;**

calculating the N-1 coordinates of each point in the N-1 dimensional space using an evolutionary algorithm; and

generating ~~defining~~ a **best** ~~the~~ projection in which the distance matrix of the points in the N-1 dimensional space best fits or has minimum differences with the

distance matrix of the points calculated in the N-dimensional space as the best projection of said points onto the N-1 dimensional space; **and**

outputting said best projection to a user,

wherein said receiving, projecting and carrying out are performed by a data processor, and wherein in said evolutionary algorithm the number of marriages and of mutations of individuals are adaptive self-definable internal variables.

83. (previously presented) The method of claim 82 wherein the database already contains distances between the records.

84. (previously presented) The method of claim 82, wherein the evolutionary algorithm is a genetic algorithm.

85. (previously presented) The method of claim 82, wherein said analysis:

encodes each individual record or variable as a point having coordinates X and Y;

defines a set of different X and Y coordinates for each point forming a first population of projections solution onto the less dimensional space, usually a two or three dimensional space;

calculates a fitness score for each of the projections of this first population by using the matrix of distances of the single points in the original N-dimensional space as a fitness function;

combines the population of projections according to certain combinatorial rules to produce a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation;

calculates a fitness score of the projections of the first generation; and

forms a new generation based on the first generation.

86. (previously presented) The method of claim 84, wherein the evolutionary algorithm is the GenD algorithm.

87. (previously presented) The method of claim 84, wherein a hidden point represented by a hidden record or a hidden variable can be defined, which corresponds to a

hidden point on the map and whose existence is only guessed at, said hidden point being added to the parent population by giving it position coordinates X_{hi} and Y_{hi} in the projection.

88. (previously presented) The method of claim 87, wherein the calculation of the evolutionary algorithm is carried out in parallel, with and without the hidden point, and best fit projections obtained by said two parallel calculations are compared.

89. (previously presented) The method of claim 82, further comprising:

providing a database comprising a certain number of records each one having a certain number of variables;

elaborating the database alternatively or in parallel according to:

a first manner by which the records are considered as being points and the variables as being the coordinates of the points; and

a second manner by which the variables are considered as being points and the records are the coordinates.

90. (previously presented) The method of claim 82, further comprising using a different algorithm to operate on the database in a pre-processing or a post-processing phase.

91. (previously presented) The method of claim 90, wherein the database is processed in a preventive stage by means of a Self Organising Map algorithm, and wherein the clusters formed by said SOP algorithm in the different units are projected onto said lesser dimensional space.

92. (previously presented) The method of claim 82, wherein the distance of the points on the map onto which the database has been projected is used as a measure of similarity of the records or variables related to said points.

93. (previously presented) The method of claim 82, wherein:

a database is provided comprising a certain number of records, each record related to a certain number of variables;

complementary variables to the variables originally provided are added to the database;

the integrated database is projected onto a lesser dimensional space, particularly on a two or three dimensional space; and

the distance between each variable and its complementary variable in said mapping is used as a measure of the relevance of said variable in the database.

94. (previously presented) The method of claim 82, wherein said method is used to evaluate the relevance of certain variables in determining a certain pathological status of individuals, and to define prototypes of individuals relative to the variables of the database and their probability of developing a certain disease.

95. (previously presented) The method of claim 94, where said method is used to analyze the probability of an individual of having or developing Alzheimer's.

96. (previously presented) The method of claim 82, implemented as a set of computer executable instructions saved on a removable computer readable storage medium.

97. (previously presented) The method of claim 72, implemented as a set of computer executable instructions saved on a removable computer readable storage medium.

98. (previously presented) The method of claim 82, wherein said method is used to generate two dimensional maps of geographic sites starting from a database comprising relative distances between the sites.

99. (currently amended) A **computerized** method for generating two or three dimensional maps of geographic sites starting from a database containing relative distances between the sites, comprising:

organizing the known or measured distance values of the geographical sites in a matrix form;

defining a two or a three dimensional space in which the position of each site is uniquely defined by two or three coordinates;

determining the positional coordinates of each geographical site in the two or three dimensional space using an evolutionary algorithm;

determining the distances of the geographical sites one ~~form~~ **<u>from</u>** the other using the calculated two or three dimensional positional coordinates of said geographical sites one from the other;

generating a matrix of distances with distance values determined according to said means;

defining as the best **<u>set of</u>** two or three dimensional coordinates of position of the totality of the geographical sites in the two or three dimensional space, the two or three dimensional coordinates of position of the said geographical sites for which the distance matrix determined therefrom best fits or has a minimum difference with the distance matrix of the known or measured distance values of the geographical sites**<u>; and</u>**

<u>outputting said best set of coordinates of position to a user,</u>

<u>wherein said organizing, defining, determining and outputting are performed by a data processor, and wherein in said evolutionary algorithm the number of marriages and of mutations of individuals are adaptive self-definable internal variables.</u>

100. (previously presented) The method of claim 98 wherein the evolutionary algorithm is a genetic algorithm.

101. (previously presented) The method of claim 99, wherein:

a) for each geographical site a first and a second set of coordinates defining the position of each geographical site in the two or three dimensional space is calculated;

b) a fitness score of the matrix of distances among the geographical sites determined by means of the first and second set of coordinates defining the position of each geographical site in the two or three dimensional space is calculated by using as a fitness function the matrix of the known or measured distances of the geographical sites;

c) the first and second set of coordinates of position of each geographical site are combined for each geographical site according to predetermined combination rules, thus producing at least a new first and second set of coordinates of position for each geographical site;

d) a fitness score of the said new first and second set of coordinates of position according to (b) is calculated; and

e) said new first and second set of coordinates of position are further combined according to (c), and (c) through (e) are repeated until at least one new first or second set of positional coordinates reaches a maximum fitness score or is greater than a minimum predefined fitness score.

102. (previously presented) The method of claim 101, wherein for each combination of at least one first and one second set of coordinates several new sets of coordinates are obtained by the combinations of the said at least first and second set of coordinates.

103. (previously presented) The method of claim 98, wherein at least one hidden or hypothetical geographical site is added to the database of geographical sites of which neither the coordinates nor the distances are known and wherein a first and a second set of coordinates for said at least one geographical site are freely defined.

104. (previously presented) The method of claim 103, wherein the calculation of the evolutionary algorithm is carried out in parallel for the database with and without the hidden or hypothetical geographical site, and wherein the best fit set of positional coordinates of the totality of geographical sites obtained by said two parallel calculations are compared.

105. (previously presented) The method of claim 98, wherein an additional pre-processing or post-processing phase is provided.

106. (previously presented) A method according to claim 105, wherein in a preventive phase the known distance data matrix is subjected to treatment by means of a Self Organising Map algorithm, and wherein the clusters formed by said SOM algorithm in the different units are then projected into said lesser dimensional space.

107. (currently amended) The method of claim 82, wherein said method is used to represent ~~the~~ **a** structure of a molecule in a three dimensional or two dimensional space by indicating only the relative distances of the atoms of the molecule.

108. (currently amended) A **computerized** method for representing the structure of a molecule in a three dimensional or two dimensional space by indicating only the relative distances of at least part of the atoms of the molecule relative to one another, comprising:

a) organizing known or measured distance values of the atoms in a matrix form;

b) defining a two or a three dimensional space in which the position of each atom is uniquely defined by two or three coordinates;

c) determining the two or three coordinates of the position in the two or three dimensional space of each atom by means of an evolutionary algorithm;

d) determining the distances of the atoms one ~~form~~ **from** the other by means of the calculated two or three dimensional coordinates of position of the said atoms one from the other;

e) generating a matrix of distances with distances determined according to (d); ~~and~~

f) defining as the best **set of coordinates** two or three dimensional coordinates of position of the totality of the atoms in the two or three dimensional space, the two or three dimensional coordinates of position of the said atoms for which the distance matrix determined therefrom best fits, or has a minimum difference, with the distance matrix of the known or measured distance values of the atoms; **and**

g) outputting said best set of co-ordinates to a user,

wherein said organizing, defining, determining, generating and outputting are performed by a data processor, and wherein in said evolutionary algorithm the number of marriages and of mutations of individuals are adaptive self-definable internal variables.

109. (previously presented) The method of claim 108, wherein the evolutionary algorithm is a genetic algorithm.

110. (previously presented) The method of claim 108, wherein:

a) for each atom a first and a second set of coordinates defining the position of the atom in the two or three dimensional space is calculated;

b) a fitness score of the matrix of distances among the atoms determined by means of the first and second set of coordinates defining the position of each atom in the two or three dimensional space is calculated by using the matrix of the known or measured distances between the atoms as a fitness function;

c) the first and second set of positional coordinates of each atom are combined according to predetermined combination rules, thus producing at least a new first and second set of positional coordinates for each atom;

d) a fitness score of said new first and second set of positional coordinates is calculated according to (b);

e) said new first and second set of positional coordinates are again combined according to (c); and

(c) through (e) are repeated until at least one new first or second set of positional coordinates reaches a maximum fitness score or is greater than a minimum predefined fitness score.

111. (previously presented) The method of claim 110, wherein for each combination of at least one first and one second set of coordinates several new sets of coordinates are obtained by combining said at least first and second set of coordinates.

112. (currently amended) A method according to claim 108, wherein at least one hidden or hypothetical atom is added to ~~the~~ **a** database of geographical sites **of atoms of the molecule** ~~having~~ of which neither the coordinates nor the distances are known and a first and a second set of coordinates for said at least one atom are freely defined.

113. (previously presented) A method according to claim 112, wherein the calculation of the evolutionary algorithm is carried out in parallel for the database provided with and without the at least one hidden or hypothetical atom and the best fit set of coordinates of position of the totality of the atoms obtained by the two parallel calculations are compared.

114. (previously presented) The method of claim 107, wherein a further pre-processing or post-processing phase is provided.

115. (previously presented) The method of claim 114, wherein in a preventive phase the known distance data matrix is subjected to treatment by means of a Self Organising Map algorithm, the clusters formed by said SOM algorithm in the different units being then processed according to said method.

116. (previously presented) The method of claim 112, used to determine the presence and/or position of at least an unknown or hidden atom in the structure of the molecule.

117. (previously presented) An apparatus having artificial intelligence provided with a processing unit, said processing unit connected to a data memory and to a program memory, wherein:

the processing unit is further connected to one or more different sensors for detecting or measuring different physical and/or chemical conditions or effects or processes characterizing or occurring in an environment;

the processing unit is further connected to data input means by means of a service person or a data input line from other data collecting apparati;

the processing unit is also connected to means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

in the program memory a program executable by the processing unit being loaded which program has a routine for driving the sensors and saving in a uniquely recognizable way each datum collected by the sensors and/or for saving data input by a service person or by other apparati, driver for activating or deactivating the means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

the program stored in the program memory further comprising means for evaluating the data collected by the sensors and/or the data inputted by a service person or by other apparati;

wherein the program includes a subroutine for executing an algorithm implementing the method of claim 72 on the collected and/or inputted data.

118. (currently amended) The apparatus of claim 117, wherein the program is provided with a subroutine for carrying out a cognitive analysis of multidimensional data by

treating the said data with a method for projecting information data belonging to a multidimensional space into a space having less dimensions comprising the following steps:

providing a database of N-dimensional data in the form of records having a certain number of variables[[.]];

defining a metric function for calculating a distance between each record of the database.

calculating a matrix of distances between each record of the database by means of the metric function defined at the previous step;

defining a N-1 dimensional space in which each record is defined by N-1 coordinates[[.]];

calculating the N-1 coordinates of each record in the N-1 dimensional space by means of an evolutionary algorithm; **and**

defining as the best projection of the records onto the N-1 dimensional space the projection in which the distance matrix of the records in the N-1 dimensional space best fits or has minimum differences with the distance matrix of the records calculated in the n-dimensional space.

119. (previously presented) The apparatus of claim 118, wherein said database already contains the distances between the records.

120. (previously presented) An apparatus according to claim 118, wherein said evolutionary algorithm is a genetic algorithm.

121. (previously presented) An apparatus according to claim 118, wherein said subroutine provides for:

encoding each individual record or variable represented by a point having coordinate X and Y;

defining a set of different X and Y coordinates for each point forming a first population of projections solution onto the less dimensional space, usually a two or three dimensional space;

calculating the fitness score for each of the projections of this first population by using as the fitness function the matrix of distances of the single points in the originally N dimensional space;

subjecting the population of projections to combination according to certain combination rules thus producing a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation; and

calculating the fitness score of the projections of the first generation and forming again a new generation basing on the first generation.

122. (previously presented) An apparatus according to claim 118, wherein the genetic algorithm is the GenD algorithm.

123. (previously presented) An apparatus according to claim 118, wherein a hidden point can be defined which corresponds to a hidden record or a to a hidden variable whose existence is only speculative, and wherein said hidden point is added in the parent population by giving it positional coordinates X_{hi} and Y_{hi} in the projection.

124. (previously presented) An apparatus according to claim 118, wherein the calculation of the evolutionary algorithm is carried out in parallel with the hidden point and without the hidden point and the best fit projections obtained by the two parallel calculations are compared.

125. (previously presented) An apparatus according to claims 118, further comprising:

providing a database comprising a certain number of records each one characterized by a certain number of variables;

elaborating the database alternatively or in parallel according to:

a first manner in which the records are considered as being points and the variables as being the coordinates of the points; and

a second manner in which the variables are considered as being points and the records are the coordinates.

126. (previously presented) An apparatus according to claim 118, further comprising a different treatment of the data as a pre or post processing phase.

127. (previously presented) An apparatus according to claim 126 characterized in that the data is processed in a preventive step by means of a Self Organizing Map algorithm, the clusters formed by said SOM algorithm in the different units then being projected onto said space of lesser dimension.

128. (previously presented) An apparatus according to claim 117, wherein a relationship between the collected data records of the collected data is determined by means of the distance of each data record from the other data records and wherein said distance is used as a relevance weight for each data record in determining the activation or deactivation of one or more of the means for carrying out mechanical, physical and/or chemical actions.

129. (previously presented) An apparatus according to claim 128, wherein a maximum distance for each data record in determining the activation or record from the other is set for discriminating the data records to be used in determining the activation or deactivation of one or more of the means for carrying out said mechanical, physical and or chemical actions.

130. (previously presented) An apparatus according to claim 128, wherein the clustering or distance of the data records on the map onto which the database has been projected is used as a measure of similarity of the data records or of the variables related to the said data records.

131. (currently amended) Apparatus having artificial intelligence containing a simulation of intuitive behaviour, comprising:

a processing unit connected to each of a data memory and a program memory, wherein the processing unit is further connected to one or more sensors for detecting or measuring different physical and/or chemical conditions or effects or processes characterising or occurring in the environment;

wherein the processing unit is further connected to data input means by means of a service person or a data input line from other data collecting apparati;

wherein the processing unit is further connected to means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

wherein the program memory stores a program executable by the processing unit, said program including a routine for driving the sensors and saving in a uniquely recognizable way each datum collected by the sensors and/or for saving data input by a service person or by other apparati, driver for activating or deactivating the means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

wherein the program stored in the program memory further comprises means for evaluating data collected by the sensors and/or inputted by a service person or by other apparati;

and wherein in operation the apparatus:

generates from the collected and/or inputted data a database with a certain number of records each one comprising a certain number of variables and which are relative to a N-dimensional space;

projects the database considering the record as points and the variables as coordinates or the variables as points and the records as coordinates onto a space having a reduced number of dimension relatively to the space N dimensional space, said projection being carried out by means of an algorithm for projecting information data belonging to a multidimensional space into a space having lesser dimensions comprising:

calculating a matrix of distances between each point defined by a record or a variable of the database by means of a metric function;

defining a N-1 dimensional space in which each point represented by a record or a variable is defined by N-1 coordinates;

calculating the N-1 coordinates of each point in the N-1 dimensional space by means of an evolutionary algorithm; and

defining as the best projection of the points onto the N-1 dimensional space the projection in which the distance matrix of the points in the n-i dimensional space best fits or has minimum differences with the distance matrix of the points calculated in the N-dimensional space[[;]],

<u>wherein in said evolutionary algorithm the number of marriages and of mutations of individuals are adaptive self-definable internal variables.</u>

132. (previously presented) The apparatus of claim 131, wherein said database already contains distances between the records.

133. (previously presented) The apparatus of claim 131, wherein the evolutionary algorithm is a genetic algorithm.

134. (previously presented) The apparatus of claim 131, further comprising:

encoding each individual record or variable represented by a point having coordinates X and Y;

defining a set of different X and Y coordinates for each point forming a first population of projections solution onto the lesser dimensional space, usually a two or three dimensional space;

calculating a fitness score for each of the projections of said first population by using as a fitness function the matrix of distances between the single points in the original N dimensional space;

combining the population of projections according to certain combinatorial rules and producing a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation; and

calculating the fitness score of the projections of the first generation and forming a new generation basing on the first generation.

135. (currently amended) The apparatus of claim 131, wherein the evolutionary algorithm is the ~~GenD~~ Genetic Doping Algorithm ~~algorithm~~.

136. (previously presented) The apparatus of claim 131, wherein a hidden point represented by a hidden record or a hidden variable can be defined, which corresponds to a hidden point on the map whose existence is only speculated, and wherein said hidden point is added to the parent population by giving it positional coordinates X_{hi} and Y_{hi} in the projection.

137. (previously presented) The apparatus of claim 136, wherein the calculation of the evolutionary algorithm is carried out in parallel with and without the hidden point and wherein the best fit projections obtained by the two parallel calculations are compared.

138. (previously presented) The apparatus of claim 131, further comprising:

providing a database comprising a certain number of records each one characterised by a certain number of variables;

elaborating the database alternatively or in parallel according to:

a first manner in which the records are considered as being points and the variables as being the coordinates of the points; and

a second manner in which the variables are considered as being points and the records are the coordinates.

139. (previously presented) The apparatus of claim 131, further comprising treating the database as a pre-processing or post-processing phase.

140. (previously presented) The apparatus of claim 139, wherein the database is processed in a preventive stage by means of a Self Organising Map algorithm, the clusters formed by said SOP algorithm in the different units being projected onto said space of lesser dimension.

141. (previously presented) The apparatus of claim 131, wherein the clustering or distance of the points on the map onto which the database has been projected is used as a measure of similarity of the records or of the variables related to the said point.

142. (previously presented) The apparatus of claim 131, wherein:

a database comprising a certain number of records, each record being related to a certain number of variables, is provided;

variables complementary to the variables originally provided are added to said database and the resulting integrated database is projected onto a space of lesser dimension, particularly onto a two or three dimensional space; and

the distance in the map between each variable and its complementary variable is used as a measure of the relevance of said variable in the database.